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**Abstract**

# THE INSTALLATION, OPERATION AND MAINTENANCE OF EXPERIMENTAL LOOPS IN REACTORS

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1. Reactor loops have been used at Chalk River since 1950 to study the behaviour of fuel and coolant systems under the thermodynamic and nuclear conditions that hold in power reactors. There are now eight such loops in the NRX reactor and fuel can be tested at high heat ratings in pressurized water, fog, steam and organic coolant. The NRX loops are limited mainly in the size of the specimens that they will carry and the neutron fluxes that are available. To overcome these limitations the NRU reactor has been equipped with loops large enough to test full-size fuel assemblies. One loop operates with water coolant in either one- or two-phase condition; another operates with organic coolant; the third is a water-steam loop that has been designed and will be installed in 1964.

2. One of the NRU loops is in the central vertical core position and the others are at sites 79 cm from the centre. Depending on the loading the thermal-neutron flux in this region ranges up to $3.10^{14}\,cm^{-2}\,s^{-1}$ and the heat output from a typical irradiation is 2 to 2.5 MW. The large size and complexity of such systems introduced many new problems in design, operation and maintenance.

3. A primary consideration is efficient layout so that components can be erected in limited space. Ready accessibility for maintenance and modification is essential. Each in-core position is fitted with highly stressed large-diameter zirconium-alloy pressure tubes. Reliable closures and joints were designed for these tubes and suitable methods developed to protect them against overpressure.

4. Operating a large organic-cooled loop at 400°C and 32 bar requires many new techniques. The relatively high pressure demands mechanical seals of high integrity with extremely reliable cooling. Thermal insulation, steam tracing, fire protection and coolant degassing presented problems in both operation and maintenance.

5. Experience in operating the small boiling-water and steam loops in NRX provided useful guides in designing the large, multipurpose, water-steam loop for NRU. This unit will be used over such a wide range of operating conditions that comparatively sophisticated instrumentation is needed for stable control.

6. Loop experiments produce large volumes of experimental data. The usefulness of automatic data acquisition and processing in situ has been demonstrated on a pilot scale and all Chalk River loops will be serviced by a combination of data logger and computer in 1964.

7. Chalk River loop experiments have led to the design and production of fuel that has performed successfully in the NPD reactor and to the production of low-cost fuel for the CANDU reactor. The loop program will be continued and expanded for studies of improved fuel systems. A loop is being designed and built for the Canada-India Reactor at Bombay; and Canada's next test reactor WR-1 will test fuel at power-reactor conditions in many of its channels.